Chapter 25

Volcano Disaster Assistance Program: Preventing volcanic crises from becoming disasters and advancing science diplomacy

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25.1 VDAP

The Volcano Disaster Assistance Program (VDAP) is a cooperative partnership of the USAID Office of US Foreign Disaster Assistance (OFDA) and the US Geological Survey (USGS). Founded in 1986 in the wake of the Nevado del Ruiz catastrophe wherein more than 23,000 people perished needlessly in a volcanic eruption, VDAP works by invitation to reduce volcanic risk, primarily in developing nations with substantial volcano hazards. The majority of emergency responses and capacity building projects occur in, but are not limited to, Pacific Rim nations. The single most successful VDAP operation was its response with the Philippine Institute of Volcanology and Seismology to the reawakening and subsequent eruption of Mount Pinatubo in 1991. This response alone saved 20,000 lives, including US military personnel at Clark Air Base, and a conservative estimate indicates that at least 250 million dollars in tangible assets were removed from harm's way ahead of the eruption (Newhall et al., 1997). More recently, in late 2010 VDAP assisted Indonesia's Center for Volcanology and Geologic Hazard Mitigation respond to the eruption of Merapi volcano, which saved 10,000 to 20,000 lives.

Figure 25.1 Map of VDAP deployments 1986-2012.

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25.2 Current activities

The VDAP team is on call to respond to volcano emergencies globally with crisis response teams. Since 1986, VDAP has responded to 25 major volcano crises. In addition to this on-call activity, VDAP has conducted capacity-building projects and helped build or strengthen volcano hazards institutions in a dozen Pacific Rim countries. The VDAP approach is to work in the background to support and strengthen our partners' crisis response and hazard mitigation programmes.

25.3 Chile

On 2 May, 2008, Chaitén volcano in southern Chile suddenly re-activated after hundreds of years of dormancy and produced the largest eruption so far in the twenty-first century. A town of more than 4,000 people lying just 10 km from the volcano had to be evacuated within 48 hours of the eruption onset. A VDAP rapid-response team assisted the Chilean Servicio Nacional de Geología y Minería (SERNAGEOMIN) to deploy radio-telemetered monitoring instruments and forecast eruption hazards. Added to the disruption of lives and livelihoods on the ground, the Chaitén eruption severely disrupted air traffic in the region. In addition to the VDAP response, two experts on volcanic ash hazards to aviation from the USGS Volcano Hazards Program traveled to Argentina and Chile to advise civilian and military aviation interests on procedures to ensure safe operations during eruptions in the region. Although not widely known prior to the Iceland eruptions of 2010, volcanic ash clouds threaten aircraft daily on a global basis and planes must be warned away from ash-contaminated airspace. Since the near-crash of several fully loaded 747s in the 1980s, the USGS, FAA and NOAA have been leaders in developing a global ash avoidance programme under the auspices of the International Civil Aviation Organization.

Figure 25.2 Gas, ash, and steam erupt from the growing lava dome in the crater of Chaitén, southern Chile, May 26, 2008. USGS photo.

Chile has within its borders more than 122 active volcanoes, only a handful of which have any monitoring in place or modern hazard assessments completed. The eruption of Chaitén spurred the Government of Chile to implement a new national plan to address its considerable volcano hazards. The resulting Red Nacional de Vigilancia Volcánica (RNVV) is modelled directly on the USGS National Volcano Early Warning System (NVEWS), an element of the USGS science strategy for natural hazards.

In 2009 and 2011, under a revitalised Memorandum of Understanding between the US and Chile for cooperation in earth science and technology, VDAP teams traveled to Chile to advise and assist with the RNVV plan's implementation. In addition, SERNAGEOMIN and USGS are continuing to work together to assess the volcanological and ecological impacts.

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Figure 25.3 Group photo of VDAP team with President Michelle Bachelet, US Ambassador to Chile Paul Simons (left) and USGS Director's representative Tom Casadevall (right). Photo taken following briefing by the team on the situation at Chaitén volcano and SERNAGEOMIN's new national volcano early warning plan (Red Nacional de Vigilancia Volcánica).

25.4 Colombia

VDAP has had an ongoing collegial crisis response and capacity-building relationship with Colombia since the disaster at Nevado del Ruiz in 1985. Over the years, VDAP has worked closely with the Instituto Colombiano de Geología y Minería (INGEOMINAS) on various projects, including direct involvement in establishing the three volcano observatories now functioning in Colombia.

In 2007-2011 VDAP worked closely with the INGEOMINAS Observatory in Popayan to monitor and forecast eruptions at Huila volcano. Like Nevado del Ruiz, Huila is a large snow-and-ice-clad volcano with a history of producing exceedingly dangerous debris flows (lahars). On 20 November 2008, following a period of escalating unrest of several weeks, Huila erupted and generated a huge debris flow. Owing to accurate forecasting and good communications with downstream communities, fewer than 10 casualties occurred in an area where in 1994 an event of similar sized killed more than 1000. Most of the credit for the success of this risk mitigation effort belongs to INGEOMINAS and other involved Colombian institutions, but the effort was, and still is, substantially supported by VDAP.

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Figure 25.4 USGS and INGEOMINAS personnel meet to define alert level system for Huila volcano, Colombia. February 2007. USGS photo.

Figure 25.5 Eruption-generated debris flow overran portions the town of Belalcazar, Colombia approximately 15 miles downstream of Huila volcano on 20 November 2008. Accurate forecasts and warnings triggered evacuation of the 4000 residents, saving lives and property. INGEOMINAS photo.

In 2008 a Memorandum of Understanding between the USGS and INGEOMINAS was signed, and subsequently the Director of INGEOMINAS has sought a Project Annex with VDAP to work with them to develop their volcano monitoring and analysis capabilities on all 15 Colombian volcanoes. Within the limitations of its resources, VDAP will continue to work with INGEOMINAS on volcano hazard mitigation in this important South American country.

25.5 Indonesia

Indonesia is the world's most volcanically active nation, with numerous eruptions each year and several million people living directly on the flanks of the volcanoes. Currently, VDAP's largest capacity-building project is conducted in partnership with the Indonesian Center for Volcanology and Geologic Hazard Mitigation (CVGHM). USGS collaboration with CVGHM's predecessor, the Volcanology Survey of Indonesia, dates back to the 1980s. At that time USGS helped evaluate hazards and establish monitoring at several of the highest-risk volcanoes, such as Merapi, located in the suburbs of Yogyakarta (metropolitan area population, 1.6 million). Following an absence of 20 years, at the invitation of CVGHM and with support of OFDA, VDAP returned to Indonesia in 2004 to help build a new regional volcano observatory in the North Sulawesi and Sangihe islands region. Over the succeeding five years, CVGHM and VDAP built what is now one of the best monitoring networks in the country, with real-time seismic monitoring of the 10 active volcanoes in place and signals relayed in real-time by satellite and internet to CVGHM offices in Bandung. In 2006,

Figure 25.6 VDAP and CVGHM scientists install a seismic station to monitor volcanic activity in North Sulawesi. USGS photo.

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VDAP sent a crisis response team to assist CVGHM during eruptions of Merapi volcano, which directly threatens the lives of several hundred thousand people. VDAP also provided seismic monitoring equipment, eruption forecasts, remote sensing, and a technical advisor to assist the OFDA Disaster Assistance Response Team (DART) during their response to the M 6.3 Yogyakarta earthquake, which took place during the eruption and killed 5,700.

In 2010 at the request of the President of Indonesia, a VDAP team was again deployed to assist CVGHM in their response to the largest eruption at Merapi in more than 100 years. VDAP and international partners utilised satellite radar data to "see through" clouds that obscured the volcano and delivered near-real-time analyses of changes directly to the CVGHM response team during the crisis. This information allowed CVGHM to assess the magnitude of the eruption and areas affected, thereby informing their decisions regarding the extent of evacuations needed. In addition, the on-site VDAP team provided technical assistance and monitoring equipment to replace systems destroyed in the early phase of the eruption and to expand the monitoring programme. Although ~380 fatalities were recorded, it is estimated that CVGHM warnings and prompt actions by the Government of Indonesia saved 10,000-20,000 lives.

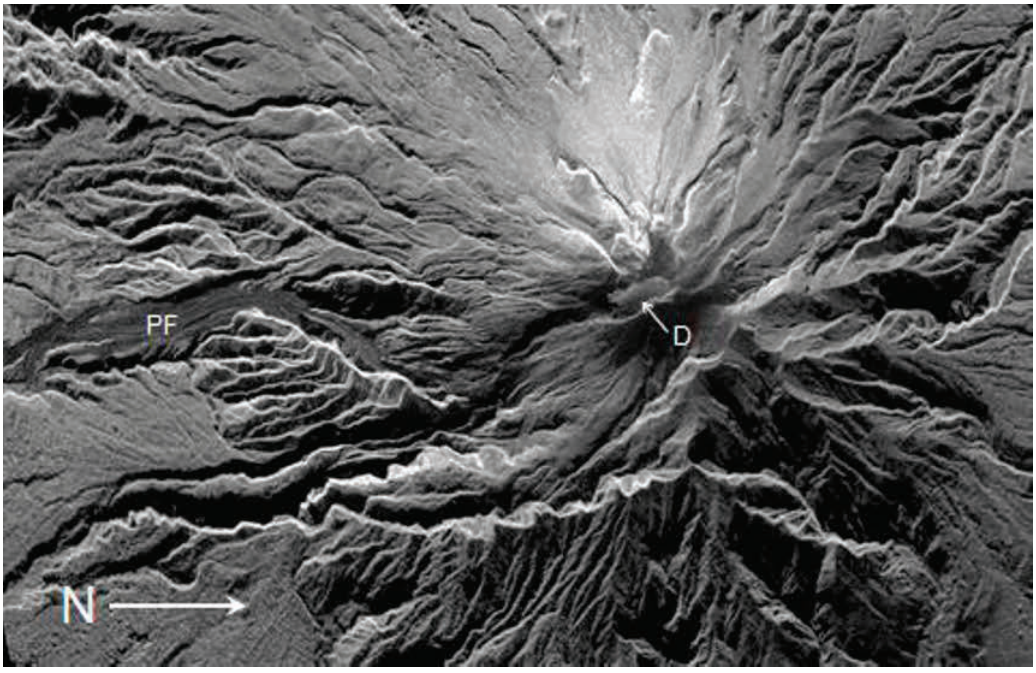

Figure 25.7 TerraSAR-X Synthetic Aperture Radar image of 4 November 2010, provided courtesy of the German Aerospace Center (DLR), showing pyroclastic flow deposits (PF) from the 26 October eruption and a new lava dome growing at the summit. Very rapid growth of the lava dome was followed by a large eruption during the night of 4-5 November.

US Ambassador Cameron Hume and the Director of the Indonesian Geology Agency, Bambang Dwiyanto, signed Annex IV to the 2006 Memorandum of Understanding between the governments of Indonesia and the US for Cooperation in Science and Technology for Natural Hazards. This Annex calls for continued VDAP assistance to CVGHM. Subsequently, VDAP was singled out among multiple international donors by CVGHM with a request to assist them in modernising volcano monitoring networks and hazard assessments in Java, where more than 100 million people live in the shadows of active volcanoes. This expansion of VDAP work was approved by OFDA and USGS in 2009. In 2010, VDAP and CVGHM completed monitoring

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installations in North Sulawesi, conducted joint training workshops and began the Java expansion with new installations and hazard assessments at Tangkuban Perahu volcano, the highly populated "city volcano" near Bandung, Java. In subsequent years, VDAP and CVGHM have worked together at Ijen, Raung and Dieng volcanoes in Java and at Agung volcano in Bali.

Figure 25.8 USAID Mission Director, Walter North (far left), VDAP Chief John Pallister (left centre) and US Ambassador to Indonesia Scot Marciel (centre) brief Indonesian Vice President Boediono on the 2010 eruption of Merapi and the effectiveness of the response by Indonesia's Center for Volcanology and Geologic Hazard Mitigation. USGS photo.

25.6 VDAP benefits to the USGS Domestic Program

Over the past 25 years, VDAP has served as a development and proving ground for much of the volcano monitoring technology and eruption forecasting science that is applied at US volcanoes. International experience in crisis response and risk mitigation has informed, strengthened, and helped guide development of domestic capabilities. The Scientists-in-Charge at the USGS Alaska and Cascades Volcano Observatories and the Director of the USGS Volcano Science Center are alumni of VDAP, and current and former VDAP scientists have helped lead responses to recent eruptions in Washington State, Alaska, and the US Commonwealth of the Northern Mariana Islands. The USGS plan for domestic volcano hazard mitigation (National Volcano Early Warning System (NVEWS)), outlined in the USGS Bureau Science Strategy, draws many key elements from decades of VDAP experience. VDAP serves as an enduring and productive strategic partnership between the US Departments of State and Interior. VDAP seeks to enhance US relationships with other nations through science diplomacy and to build international friendships through work toward a shared goal of saving lives and property.

Reference

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